New superconducting phases in $Mo_2Re_3B_x$-$Mo_3Re_2B_x$ eutectic

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We discovered superconducting eutectic composed of new, previously unknown superconducting phases, namely of $Mo_2Re_3B_x$ and of $Mo_3Re_2B_x$ (where $x \approx 1$) and investigated its basic properties. The phases present in the eutectic were identified by means of EDS analyses. These systems belong to the family of boride superconductors and to the ternary boride compounds which exhibit strong electron-phonon interaction and high frequency vibration of lighter elements promoting enhanced critical temperatures. In the case of $Mo_3Re_2B_x$ and $Mo_2Re_3B_x$ phases the transition temperatures to superconducting states were equal to 6.6 K and to 8.7 K, respectively.

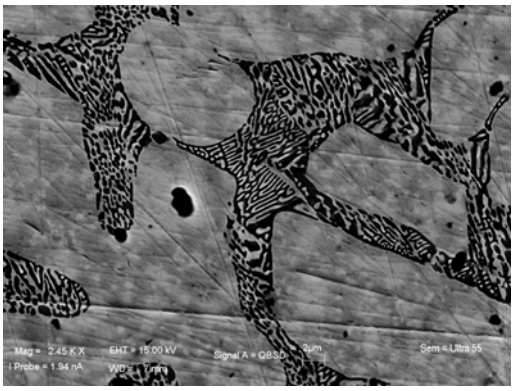

Fig. 1. The microstructure of $Mo_2Re_3B_x$-$Mo_3Re_2B_x$ eutectic.

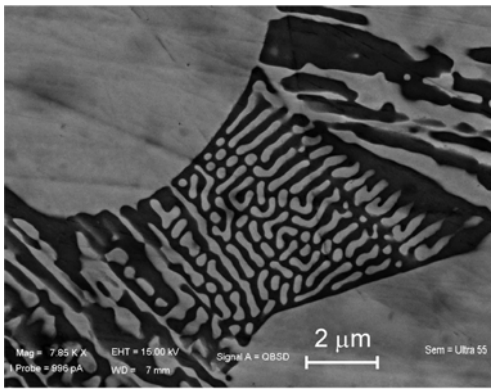

Fig. 2. The regular lamellar structure composed of the $Mo_2Re_3B_x$ and $Mo_3Re_2B_x$ phases.

The structure and geometry of eutectics strongly influences theirs basic, superconducting characteristics like type of superconductivity, critical temperature and fields, flux pinning and critical currents. It was found that the eutectic was composed of large $Mo_3Re_2B_x$ grains and of eutectic regions formed by $Mo_2Re_3B_x$ and $Mo_3Re_2B_x$ phases with regular lamellar structure. It was also shown that the two phases in the lamellar regions were separated by thin boron interface and formed regular network of Josephson junctions.

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